CLAIMS:

1.          An image processing method for noise filtering an image sequence representing a threadlike structure on a background, including an acquisition of point data in first and second sequence images and an estimation of the corresponding filtered point data for constructing a filtered second image, the point data being the intensities associated to co-ordinates of image points, said method comprising, performed in each sequence image, steps of:

        extracting the threadlike structure points, forming strings from said extracted points, temporally filtering the data of the points located outside the strings denoted background points, spatially filtering the data of the string points,

        and constructing the filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points.

2.          A method as claimed in Claim 1, comprising steps of :

        based on the string formation performed in said sequence images, providing a binary control signal [St(i,j)] formed of a list of the string points with their running number on the strings and their co-ordinates in the processed image, which determines whether the current point is a string point or a non-string point regarded as a background point.

3.          A method as claimed in Claim 2, comprising, for constructing the filtered second image, steps of :

        supplying said binary control signal (St(i,j)) for controlling the insertion of the spatially filtered data of the string points into the temporally filtered data of the background points.

4.          A method as claimed in Claim 3, comprising, for eliminating phantom artifacts due to temporal filtering of the background data, steps of :

        delivering the binary control signal [St(i,j)] for controlling the insertion operation through a logic OR operation, whose inputs are the first and the second control

binary signals related to the first and the second sequence images, said OR operation triggering the spatially filtered data when at least one of the two binary control signals corresponds to a string point.

5    5.        A method as claimed in Claim 4, including a spatial filtering operation performed on string point data, comprising steps of :

selecting string points [A(i,j)] using the list of the control signal [St(i,j)],

propagating on one string from its start point to its end point, according to the running number on the string,

10   while propagating, performing a spatial filtering on each point of the string in a causal then in an anti-causal direction as using a temporal filtering technique,

and constructing a filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points, controlled by the binary control signal.

15   6.        A method as claimed in Claim 5, comprising for enhancing the string point data, steps of :

selecting of a string point [A(i,j)] using the list of the control signal [St(i,j)], said string point having a spatially filtered intensity [U(i,j)], forming a neighborhood (V) for

20   said string point using background points having temporally filtered intensities and estimating a mean temporally filtered intensity in said neighborhood [Ū(V)];

estimating the local contrast [LC(i,j)] related to said string point as a difference between said mean intensity in said neighborhood and the intensity of said string point and multiplying said contrast by a factor (C) for providing an enhanced contrast

25   [C.LC(i,j)];

and calculating the enhanced string point intensity [Ft(i,j)] as the difference between the enhanced contrast and the mean intensity [Ū(V)] in the neighborhood (V) of said point.

Claims

30   7.        A method as claimed in one of ~~Claims 5 or 6,~~ including an enhancement operation performed on spatially filtered string point data, comprising steps of :

selecting string points [A(i,j)] using the list of the control signal [St(i,j)],

enhancing the string point data with respect to their local environment,

and constructing a filtered second image data by performing an insertion of the enhanced spatially filtered data of the string points into the temporally filtered data of the background points, controlled by the binary control signal.

8.          A method as claimed in ~~one of the preceding Claims~~ Claim 1, wherein the images are medical examination digital images and the threadlike structure is a catheter guide-wire.

9.          A system comprising a suitably programmed computer of a workstation or a special purpose processor having circuit means, which are arranged to process image data according to the method as claimed in ~~any of Claims 1 to 8~~ Claim 1, and having means to display images processed according to said method, and possible means to store the image data.

10.          An X-ray apparatus having means for acquiring medical digital image data and having a system as claimed in claim 9, having access to said medical digital image data for processing said image data.

11.          A computer program product comprising a set of ~~instruction~~ instructions for carrying out a method as claimed in ~~one of claims 1 to 8~~ Claim 1.

add A4